Irem Y. Tumer

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PERSONAL DATA:

Citizenship: US Citizen.
Date of Birth: 8-9-68.
References available upon request.

EDUCATION:

The University of Texas, Austin, Texas

Ph.D. in Mechanical Engineering, May 1998.
Dissertation title: *Foundations of Condition Monitoring for Manufacturing and Design*

M.S.E. in Mechanical Engineering, May 1995.

B.S. in Mechanical Engineering, December 1991.

RESEARCH INTERESTS:

Design for failure-free missions; vehicle health monitoring and diagnosis; fault detection; failure analysis and modeling; function-failure similarity; variation analysis and modeling; failure and risk identification; risk-based design; vibration monitoring; statistical analysis; signal processing.

TEACHING EXPERIENCE:

Fall 1996:

Introduction to Mechanical Engineering
Team-taught a freshman introductory engineering course with Dr. K.L. Wood.
Topics: Mechanical Dissection, Reverse Engineering, Modeling, Manufacturing Processes.

Summer 1996:

Supervised Teaching in Mechanical Engineering
Delivered and critiqued lectures.
Topics: Fourier Transform and Power Spectrum; Reverse Engineering.

WORK EXPERIENCE:

September 2000 to Present:

Nasa Ames Research Center
Research Scientist, Computational Sciences Division.

July 1998 to September 2000:

Caelum Research Corporation/Computer Sciences Corporation
Nasa Ames Research Center
Research Scientist, Computational Sciences Division.

September 1992 to May 1998:

The University of Texas, Austin
Graduate Research Assistant, Dept. of Mechanical Engineering.

September 1996 to December 1996:
The University of Texas, Austin
Teaching Assistant, Dept. of Mechanical Engineering.
Instructor for "Introduction to Mechanical Engineering".

June 1992–August 1992:
The University of Texas, Austin
Research Assistant, Dept. of Mechanical Engineering.
Worked on an NSF-sponsored summer project:
Fractal-Based Tolerance Representations in Engineering Design
and Manufacturing, with Applications in Machining Mechanics.

September 1991–May 1992:
Houston Instrument, Austin, Texas
Product Marketing Technician.
Performed accuracy and repeatability tests on Houston Instrument plotters.

September 1991–December 1991:
The University of Texas, Mechanical Engineering
Grader for Dynamic Systems and Control.

January 1990–May 1990:
The University of Texas, Mechanical Engineering
Grader for Computer Graphics.

September 1988–August 1990 (Three full semesters):
ROLM Systems, Austin, Texas
Coop Assistant Engineer.
Assisted mechanical and industrial engineers in short-term design projects.

January 1988–May 1988:
The University of Texas, International Office
Student Assistant in Study Abroad Exchange Programs.

PUBLICATIONS:

- **Archival Journal Articles:**

1. I.Y. Tumer, R.B. Stone, "Mapping Function to Failure during High-Risk Component Development." *Journal of Research in Engineering Design.* Vol. 14, 2003, pp.25-33.
2. I.Y. Tumer, E.M. Huff, "Analysis of Triaxial Vibration Data for Health Monitoring of Helicopter Gearboxes." *ASME Journal of Vibration and Acoustics.* Vol.125, No.1, pp.120-128. 2003.
3. I.Y. Tumer, E.M. Huff, "On the Effects of Production and Maintenance Variations on Rotating Machinery Component Performance." *Journal of Quality in Maintenance and Engineering.* Vol. 8, No. 3, pp.226-238. 2002. (Highly Commended Award, 2002 Journal Volume, Emerald, Literati Club.)
4. E.M. Huff, I.Y. Tumer, E. Barszcz, M. Dzwonczyk, J. McNames, "Analysis of Maneuvering Effects on Transmission Vibrations in an AH-1 Cobra Helicopter". *Journal of the American Helicopter Society*. Volume 47, No. 1, pp. 42-49. January 2002.
5. I.Y. Tumer, K.L. Wood, I.J. Busch-Vishniac, "Monitoring of Manufacturing Signals Using the Karhunen-Loève Transform." *Mechanical Systems and Signal Processing Journal*, 2000, 14(6), pp.1011-1026.

6. I.Y. Tumer, R.G. Longoria, K.L. Wood, "Signal Analysis Using Karhunen-Loève Transformation: Application to Hydrodynamic Forces." *The ASME Journal of Offshore Mechanics and Arctic Engineering*. Volume 122, No.3, pp.208-213. August 2000.
7. I.Y. Tumer, K.L. Wood, I.J. Busch-Vishniac, "A Mathematical Transform to Improve Part Surface Quality in Manufacturing." *The ASME Journal of Manufacturing Science and Engineering*. Volume 122, No. 1, pp. 273-279. February 2000.
8. I.Y. Tumer, D.C. Thompson, R.H. Crawford, K.L. Wood, "Characterization of Surface Fault Patterns, with Application to a Layered Manufacturing Process." *The Journal of Manufacturing Systems*, Volume 17, No.1, pp.23-36, 1998.
9. I.Y. Tumer, R.S. Srinivasan, K.L. Wood, "Investigation of Characteristic Measures for the Analysis and Synthesis of Precision-Machined Surfaces." *The Journal of Manufacturing Systems*, Volume 14, No.5, pp.378-392, 1995.
10. I.Y. Tumer, R.B. Stone, R. A. Roberts "Decomposition-based failure mode identification method for risk-free design in large systems." **In review**. 2002.
11. S.G. Arunajadai, R.B. Stone, I.Y. Tumer, "Failure mode identification through clustering analysis." **In review.** 2002.
12. R.A. Roberts, R.B. Stone, I.Y. Tumer, "Application of function-failure similarity method to rotorcraft component design." **In review.**
13. D.A. McAdams and I.Y. Tumer, "Modeling variability in dynamic systems for vehicle health monitoring." **In review.**
14. D.A. McAdams and I.Y. Tumer, "Toward Intelligent fault detection in turbine blades: Variational vibration models of damaged pinned-pinned beams." **In review.**
15. M.E. Stock, R.B. Stone, I.Y. Tumer, "Going back in time to improve design: The Elemental Function-Failure Design Method." **In Review.**
16. M.E. Stock, R.B. Stone, I.Y. Tumer, "Comparing two levels of functional detail for mapping historical failures: you are only as good as your knowledge base." **In review**.

- **Book Chapters:**

1. I.Y. Tumer, R.S. Srinivasan, K.L. Wood, "Analysis and Synthesis of Engineering Surfaces to Bridge Manufacturing and Design." Invited book chapter in *Computer Aided and Integrated Manufacturing Systems Techniques and Applications*, Volume VI: Manufacturing Systems Processes. pp.1:1-45. CRC Press. 2001.

- **Full-Paper Refereed Conference Articles:**

1. I.Y. Tumer, R. B. Stone, D.G. Bell, "Requirements for a failure mode taxonomy for use in conceptual design." *International Conference on Engineering Design*, Paper No. 1612, Stockholm, Sweden. August 2003.
2. M.E. Stock, R.B. Stone, I.Y. Tumer, "Going back in time to improve design: The Elemental Function-Failure Design Method." *Design Theory and Methodology Conference*, *ASME Design Engineering Technical Conferences.* DETC2003/DTM-48633. Chicago, IL. September 2003.
3. M.E. Stock, R.B. Stone, I.Y. Tumer, "Comparing two levels of functional detail for mapping historical failures: you are only as good as your knowledge base." *ASME International Mechanical Engineering Congress and Exposition*, IMECE2003-41593, Washington, D.C. November 2003.
4. D.A. McAdams, D. Comella, I.Y. Tumer, "Developing variational vibration models of damaged beams: toward intelligent failure detection." *ASME International Mechanical Engineering Congress and Exposition*, IMECE2003-42540, Washington, D.C. November 2003.

5. R.A. Roberts, I.Y. Tumer, R.B. Stone, A.F. Brown, "A function-based exploration of JPL's problem and failure reporting database." *ASME International Mechanical Engineering Congress and Exposition*, IMECE2003-42769, Washington, D.C. November 2003.
6. N. Oza, I.Y. Tumer, K. Tumer, E. M. Huff, "Classification of aircraft maneuvers for fault detection." *Multiple Classifier Systems Workshop*. Surrey, England, July 2003.
7. S.G. Arunajadai, R.B. Stone, I.Y. Tumer, "A clustering based approach for failure mode identification." *ASME International Mechanical Engineering Congress and Exposition*. IMECE2002-DE-34422. New Orleans, LA. November 2002.
8. I.Y. Tumer, R.B. Stone, R.A. Roberts, "Towards failure-free design: Reducing dimensionality in function-failure similarity analysis for large databases." *ASME International Mechanical Engineering Congress and Exposition*, Reliability and Failure Analysis. IMECE2002-33473. New Orleans, LA. November 2002.
9. S.G. Arunajadai, R.B. Stone, I.Y. Tumer, "A framework for creating a function-based design tool for failure mode identification." *Design Theory and Methodology Conference, ASME Design Engineering Technical Conferences*. DETC2002/DTM-34018. Montreal, Canada. September 2002.
10. D.A. McAdams and I.Y. Tumer, "Towards failure modeling in complex dynamic systems: impact of design and manufacturing variations." *Design for Manufacturing Conference, ASME Design Engineering Technical Conferences*. DETC2002/DFM-34161. Montreal, Canada. September 2002.
11. R.A. Roberts, R.B. Stone, I.Y. Tumer, "Deriving function-failure similarity information for failure-free rotorcraft component design." *Design for Manufacturing Conference, ASME Design Engineering Technical Conferences*. DETC2002/DFM-34166. Montreal, Canada. September 2002.
12. I.Y. Tumer, R.B. Stone, "Analytical Method to Evaluate Failure Potential during High-Risk Component Development." *Design for Manufacturing Conference, ASME Design Engineering Technical Conferences*. DETC2001-DFM21173. Pittsburgh, PA. September 2001.
13. I.Y. Tumer, E.M. Huff, "Using Triaxial Vibration Data for Vibration Monitoring of Helicopter Gearboxes." *Mechanical Vibration and Noise Conference, ASME Design Engineering Technical Conferences*. DETC2001-VIB21755. Pittsburgh, PA. September 2001.
14. I.Y. Tumer, E.M. Huff, "Evaluating Manufacturing and Assembly Errors in Rotating Machinery to Enhance Component Performance." *The 2000 Design for Manufacturing Conference, ASME Design Engineering Technical Conferences*. DETC00-DFM14006. Baltimore, MD. September 2000.
15. I.Y. Tumer, K.L. Wood, I.J. Busch-Vishniac, "Condition Monitoring Methodology in Manufacturing and Design." *The 1998 Design for Manufacturing Conference, ASME Design Engineering Technical Conferences*. DETC98-DFM5824. Atlanta, GA. September 1998.
16. I.Y. Tumer, K.L. Wood, I.J. Busch-Vishniac, "Monitoring Fault Condition During Manufacturing Using the Karhunen-Loève Transform." *The 1997 Sixteenth Biennial Conference on Mechanical Vibration and Noise, ASME Design Engineering Technical Conferences*. DETC97-VIB4234. Sacramento, CA. September 1997.
17. I.Y. Tumer, K.L. Wood, I.J. Busch-Vishniac, "Improving Manufacturing Precision Using the Karhunen-Loève Transform." *The 1997 Design for Manufacturing Conference, ASME Design Engineering Technical Conferences*. DETC97-DFM4347. Sacramento, CA. September 1997.
18. I.Y. Tumer, R.S. Srinivasan, K.L. Wood, "Characteristic Measures for the Representation of Manufactured Surfaces." *The 1996 Design for Manufacturing Conference, ASME Design Engineering Technical Conferences*. DETC96-DFM1275. Irvine, CA. August 1996.
19. I.Y. Tumer, R.S. Srinivasan, K.L. Wood, I.J. Busch-Vishniac, "Fractal Precision Models of Lathe-Type Turning Machines." *The 1993 Design Automation Conference, ASME Design Engineering Technical Conferences*. Volume 65-2, pp. 501-513. Albuquerque, NM. September 1993.

- **Extended Summary-Refereed Conference Articles:**

1. I.Y. Tumer and E.M. Huff, "Principal components analysis of triaxial vibration data from helicopter transmissions." *Proceedings of the 56th Meeting of the Society for Machinery Failure Prevention Technology*, pp. 331-341. Virginia Beach, VA, April 2002.

2. E.M. Huff, I.Y. Tumer, M. Mosher, "An Experimental Comparison of Transmission Vibration Responses from OH-58c and AH-1 Helicopters." *The Vertical Flight Society's 57th Annual Forum, American Helicopter Society*, Washington, D.C., May 2001.
3. E.M. Huff, I.Y. Tumer, E. Barszcz, D. Lewicki, H. Decker, "Experimental Analysis of Mast Lifting and Bending Forces on Vibration Patterns before and after Pinion Reinstallation in an OH-58 Transmission Test Rig". *The Vertical Flight Society's 56th Annual Forum, American Helicopter Society*, Virginia Beach, VA. May 2000.
4. E.M. Huff, E. Barszcz, I.Y. Tumer, M. Dzwonczyk, J. McNames, "Experimental Analysis of Steady-State Maneuvering Effects on Transmission Vibration Patterns Recorded in an AH-1 Cobra Helicopter". *The Vertical Flight Society's 56th Annual Forum, American Helicopter Society*, Virginia Beach, VA. May 2000. (Best Paper Award.)
5. I.Y. Tumer, K.L. Wood, I.J. Busch-Vishniac, "Extraction of Fault Features on SLS Part Surfaces Using the Karhunen-Loève Expansion Technique." *Proceedings of the 1996 Solid Freeform Fabrication Symposium*, pp. 575-585, Austin, TX. August 1996.
6. I.Y. Tumer, D.C. Thompson, R.H. Crawford, K.L. Wood, "Quantification of Part Surface Quality: Application to Selective Laser Sintering." *1996 World Automation Conference Proceedings*, pp. 731-736, Montpellier, France. May 1996.
7. I.Y. Tumer, D.C. Thompson, R.H. Crawford, K.L. Wood, "Surface Characterization of Polycarbonate Parts in Selective Laser Sintering." *Proceedings of the 1995 Solid Freeform Fabrication Symposium*, pp. 181-188, Austin, TX. August 1995.
8. I.Y. Tumer, I.J. Busch-Vishniac, K.L. Wood, "Modeling of Dynamic Errors Caused by the Beam Delivery System in Selective Laser Sintering." *Proceedings of the 1995 Solid Freeform Fabrication Symposium*, pp. 353-361, Austin, TX. August 1995.

- **Short-Abstract Refereed Conference/Workshop Articles:**

1. I.Y. Tumer and A. Bajwa, "A Survey of Aircraft Engine Health Monitoring Systems". The *1999 Joint Propulsion Conference, Aerospace Systems Condition Monitoring* session, Los Angeles, CA. June 1999.
2. I.Y. Tumer and A. Bajwa, "Learning about how Aircraft Engines Work and Fail". The *1999 Joint Propulsion Conference, Propulsion Education* session, Los Angeles, CA. June 1999.
3. D.A. McAdams, I.Y. Tumer, and K.L. Wood, "An Overview of Tolerance Design for Function and Manufacturing Precision in Product Design." *1998 NSF Design and Manufacturing Conference*, Monterrey, Mexico, January 5-8, 1998.
4. I.Y. Tumer and L.F. Arthur, "Benefits of Team-Teaching for Doctoral Students Preparing for an Academic Career." *1998 ASEE Annual Conference, Graduate Studies Division*, Seattle, Washington. June 1998. (Best Paper Award.)
5. E. Matsumoto, L.F. Arthur, I.Y. Tumer, J. Gray, "How to Establish an ASEE Student Chapter?", *1997 ASEE Annual Conference*, Milwaukee, WI, June 1997, Paper No.2312.
6. R. Cavin, I.Y. Tumer, M.W. Foohey, "Design of Work Jigs to Assist the Disabled in Sheltered Workshops in the Production of Sample Display Chains." *Proceedings of the 1995 Rehab. Engineering Society of North America Conference (RESNA '95)*, Vancouver, BC, Canada, pp. 725-727. June 1995. (Winner of the Design Competition.)
7. K.L. Wood, R.S. Srinivasan, I.Y. Tumer, R. Cavin, "Fractal-Based Tolerancing: Theory, Dynamic Process Modeling, Test Bed Development and Experiments." *Proceedings of the 1993 NSF Design and Manufacturing Systems Conference*, Charlotte, NC, Volume 1, pp. 731-740. September 1993.

PROFESSIONAL ACTIVITIES:

- **ASME Design Engineering Technical Conferences:**

  Conference Chair, 2002 ASME Design for Manufacturing Conference, DETC 2002, Montreal, Canada.

  Organizer, Special Panel on Risk-Based Design, 2003 ASME Design Engineering Technical Conferences. Co-organizers: Stephen Prusha, NASA/JPL, Mike Shirley, NASA Ames Research Center, Erik Antonsson, NASA/JPL/Caltech.

  Review Coordinator, 2003 ASME Design Theory and Methodology Conference, Chicago, IL.

  Program Chair, 2001 ASME Design for Manufacturing Conference, Pittsburgh, PA.

  Paper reviewer, DETC 2000, 2001, 2002, 2003.

  Paper Review Coordinator and session chair for the ASME Design for Manufacturing Conference, 2000, 1999.

  Tutorials Chair for the ASME Design for Manufacturing Conference, DETC 1999.

  Session Chair for the ASME Mechanical Vibration and Noise Conference, sessions on Fault Diagnostics in Rotating Machinery, DETC 1999.

  Paper presentations at the ASME Design Engineering Technical Conference, DTM, DFM, VIB. 1993-now.

- **NASA activities, meetings, and briefings:**

  – *Program Involvement and Activities*

    Reviewer for ECS NRA proposals. 2003.

    Ames Program Management Council presentations (monthly).

    Level 3 Program Manager, Systems Reasoning and Risk Management, Core Risk Research, Engineering of Complex Systems (ECS) Program. October 2002-now.

    Training: Research Project Management Course. NASA ARC. September 2002.

    COTR Training. 2001.

    Task lead, "Design for Failure-Free Missions." In-house funding, Engineering of Complex Systems Program. 2002.

    Task lead, "Anomaly detection for failure-free aerospace missions." In-house funding, Intelligent Systems Program. 2001-2003.

    SBIR Proposal Reviewer: 1) Diagnoser of Operational Condition and Tracker of Reliability; 2) On-Line Health Monitoring of Flight Vehicles. July 2001.

    C-17 Dryden Program Review Meeting: vibration monitoring reviewer. Pratt & Whitney, Hartford, CT. 2001.

    Technical lead, "Condition-Based Maintenance: Analysis and Understanding of Compressor Vibrational Data"; part of research funded through the IT Base Program for the Systems' Health & Safety Group. 1998.

  – *Academic Involvement*

    Summer Student from Stanford University, RIACS SSRP fellowship, Study of NASA's Peer Design Reviews. Summer 2003.

    Summer Student from Stanford University, QSS, Analysis and modeling of variations in aircraft engines. Summer 2003.

    Summer student from University of Missouri-Rolla, QSS, Development of failure mode taxonomy for space missions, JPL. Summer 2003.

    Thesis committee member for two grant students at the University of Missouri-Rolla.

    Co-PI on seven NASA Intelligent Systems Program proposals to the 2003 NRA.

    Co-PI in an NSF IGERT Proposal in collaboration with the University of Missouri-Rolla.

    NASA technical lead and officer: Cooperative agreement with Prof. Todd Leen, "Model-Biased, Data-Driven, Adaptive Failure Prediction", Oregon Graduate Institute.

    NASA technical lead and officer: Cooperative agreement with Prof. Robert B. Stone, "Analytical Methods to Capture Potential Failure Modes", Department of Basic Engineering, University of Missouri-Rolla.

NASA technical lead and officer: Cooperative agreement with Prof. Daniel A. McAdams, "Predicting and simulating monitored failure signals: computation and experimentation", Department of Mechanical and Aerospace Engineering, University of Missouri-Rolla.

- **Additional Technical Activities:**

Presenter, International Conference on Engineering Design. August 2003.

Reviewer, ASME IMECE Conference.

Reviewer, Design Studies Journal, Journal of Mechanical Design.

Presenter, MFPT 2002 Conference, Virginia Beach, VA. April 2002.

Invited presenter, AAAI Spring Symposia, Information Refinement and Decision Making for Diagnostics and Prognostics. Stanford, CA. March 2002.

Invited Panelist: Special panel on "Emerging Issues: Opportunities and Directions in Quality, Statistics, and Reliability", INFORMS'2001. Miami Beach, FL. November 2001.

American Helicopter Society Annual Conferences: Technical presentations at the American Helicopter Society Annual Forum, Virginia Beach, VA, May 2000 and Washington, D.C., May 2001; Committee meeting for Health Usage and Monitoring Systems planning; Technical Presentation Meeting with RITA members.

Invited attendee and presenter at the AI in Manufacturing Workshop, ICJAI'01, Seattle, WA, August 2001.

Invited presenter and local host at the 5th Annual Key Characteristics Conference, April 2001, Sunnyvale, CA.

Attendee at the 2000 AAAI conference, August 2001, Austin, TX.

Invited attendee at the 4th Annual Key Characteristics and Variation Risk Management Symposium, Long Beach, Ca, January 2000.

Invited attendee at the 1999 AAAI Symposium on the Use of AI in Equipment Maintenance in Manufacturing, Stanford, Ca, March 1999.

Paper presentations at the AIAA/ASME/ASEE/SAE Joint Propulsion Conference, Los Angeles, CA. 1999.

Attendee at the 1999 International Conference on Bond Graph Modeling, ICBGM'99, The Society for Computer Simulation, San Fransisco, CA, January 1999.

Attendee at the 1999 World Aviation Congress, San Fransisco, October 1999.

Paper presentations at the 1995 and 1996 Solid Freeform Fabrication Symposiums, Austin, TX.

Invited article in the Advanced Manufacturing Technology Newsletter (John Wiley & Sons), Vol.21, No. 8/August 15, 2000.

Book reviews for ASME, September 2000.

Course on Principles of Vibration Measurement and Analysis, Santa Clara, Ca, 1999.

Member of *The American Society of Mechanical Engineers (ASME), The American Helicopter Society (AHS), The Society of Manufacturing Engineers (SME), The Society of Automotive Engineers (SAE), The American Society of Engineering Education (ASEE), Pi Tau Sigma Honor Society*.

HONORS & AWARDS:

Journal of Quality in Maintenance Engineering, 2002 Volume, Highly Commended Paper Award. 2003.
American Helicopter Society's Annual Forum, HUMS session: Best Paper Award, May 2000.
NASA Performance Awards, January 2001-June 2003.
University of Texas Continuing Fellowship: Fall 1996-Spring 1997.
AAUW Doctoral Fellowship: Selected as an Alternate Winner, May 1997.
Alcoa Foundation Fellowship: Fall 1995-Spring 1996.
Winner of Best Paper Award, Graduate Studies Division, ASEE'98, Seattle, WA
Winner of Student Design Competition in RESNA '95, Annual Conference for the Rehabilitation Engineering Society of North America: Summer 1995.
Dean's Honor Roll: Spring 1988, Spring 1989, Fall 1990, Spring 1991. Dean's List: Fall 1987.